Part 1 – Amendment to the Claims

1. (Original) A method of recovering natural gas from a well in a multiple phase gas recovery cycle, the well having a casing chamber defined by a casing within the well, a production chamber within a production tubing inserted into the casing chamber and a lift chamber defined by a lift tube inserted within the production chamber, the well also including a one-way valve separating the production chamber from the casing chamber; the gas recovery cycle including a three chamber evacuation phase in which a relatively low pressure is applied within the casing chamber, production chamber and lift chamber to cause the relatively low pressure to augment natural earth formation pressure and flow more liquid and gas into the casing chamber than would flow only from the natural formation pressure, a liquid capture phase in which relatively high pressure gas is applied to the casing chamber to move liquid within the casing chamber through the one-way valve into the production chamber, and a liquid removal phase in which relatively high pressure gas is applied to the production chamber to close the one-way valve and to isolate the production chamber from the casing chamber and to lift liquid isolated in the production chamber up the lift chamber, and a liquid reduction phase executed after the three chamber evacuation phase and before the liquid capture phase by:

applying relatively high pressure within the production chamber to close the one-way valve and to isolate the production chamber from the casing chamber and to lift the liquid accumulated within the production chamber during the three chamber evacuation phase out of the well through the lift chamber; while

maintaining the relatively low pressure within the casing chamber.

2. (Original) A method as defined in claim 1, further comprising:

flowing natural gas from the casing chamber out of the well during the liquid reduction phase.

3. (Original) A method as defined in claim 1, further comprising:

beginning the liquid reduction phase after sensing a predetermined

amount of natural gas flow from the casing chamber out of the well.

4. (Previously Presented) A method as defined in claim 1, further comprising:

beginning the liquid reduction phase after sensing a predetermined pressure of natural gas in the casing chamber.

5. (Original) A method as defined in claim 1, further comprising:

beginning the liquid reduction phase after sensing a predetermined reduction in natural gas flow from the casing chamber out of the well and after sensing a predetermined pressure of natural gas in the casing chamber.

6. (Original) A method as defined in claim 1, further comprising:

reducing the amount of liquid to be lifted during the liquid removal phase by lifting liquid during the liquid reduction phase.

7. (Presently Amended) A method as defined in claim 6 wherein the pressurized gas used during the gas recovery cycle to lift liquid through ~~from~~ the lift chamber is supplied by a compressor having a predetermined capacity, and the method further comprises:

establishing the quantity of liquid to be lifted during the liquid reduction phase to not exceed the predetermined capacity of the compressor.

8. (Previously Presented) A method as defined in claim 7, further comprising:

reducing the quantity of liquid to be lifted during the liquid removal phase by executing the liquid reduction phase; and

establishing the quantity of liquid to be lifted during the liquid removal phase to not exceed the predetermined capacity of the compressor.

9. (Previously Presented) A method as defined in claim 8, further comprising:

beginning the liquid reduction phase after sensing a predetermined reduction in natural gas flow from the casing chamber out of the well and after sensing a predetermined pressure of natural gas in the casing chamber; and

selecting the predetermined reduction of natural gas flow from the casing chamber and the predetermined pressure of natural gas in the casing chamber at which to begin the liquid reduction phase to correlate to a column of accumulated liquid within the casing chamber at the well bottom.

10. (Original) A method as defined in claim 9, further comprising:

selectively beginning the liquid reduction phase prior to the column of accumulated liquid presenting a hydrostatic head pressure greater than the natural earth formation pressure.

11. (Original) A method as defined in claim 1, further comprising:

lifting quantities of liquid during the liquid reduction and liquid removal phases to maximize the duration of the three chamber evacuation phase.

12. (Presently Amended) A method as defined in claim 1, further comprising:

ending the liquid removal phase after sensing [[a]] predetermined pressures in the production and lift chambers.

13. (Original) A method as defined in claim 1, further comprising:

preventing substantial liquid in the production chamber and the lift chamber from flowing into the casing chamber during the liquid reduction phase.

14. (Original) A method as defined in claim 1, further comprising:

preventing substantial liquid in the casing chamber from flowing into the production chamber and the lift chamber during the liquid reduction phase.

15. (Original) A method of recovering natural gas from a well in a multiple phase gas recovery cycle, the well having a casing chamber defined by a casing within the well, a production chamber within a production tubing inserted into the casing chamber and a lift chamber defined by a lift tube inserted within the production chamber, the well also including a valve separating the production chamber from the casing chamber; the gas recovery cycle including a casing evacuation phase in which a relatively low pressure is applied within the casing chamber to cause the relatively low pressure to augment natural earth formation

pressure and flow more liquid and gas into the casing chamber than would flow only from the natural formation pressure, a liquid capture phase in which liquid from the casing chamber is moved through the valve into the production chamber, and a liquid removal phase in which liquid isolated in the production chamber by the valve is lifted up the lift chamber and out of the well, and a liquid reduction phase executed after the evacuation phase and before the liquid capture phase by:

lifting liquid accumulated within the production chamber during the evacuation phase out of the well through the lift chamber; while

maintaining the relatively low pressure within the casing chamber.

16. (Previously Presented) A method of recovering natural gas from a well extending from the earth surface to a subterranean earth formation from which gas and liquid are produced at a bottom of the well and transported from the bottom of the well through a casing chamber, a production chamber and a lift chamber extending between the well bottom and the earth surface; the method executed by using a multiple phase production cycle, the multiple phase production cycle including an evacuation phase in which a relatively low gas pressure is applied to the casing chamber, the production chamber and the lift chamber to communicate through the chambers to the well bottom and with the earth formation from which the gas and liquid are produced, and the multiple phase production cycle also including a liquid reduction phase which is executed separately from a liquid removal phase during each production cycle; the liquid reduction phase and the liquid removal phase each including:

applying a relatively high pressure to the production chamber while applying a relatively low pressure to the casing chamber, and

opening the lift chamber to flow liquid and gas therethrough to the earth surface; and wherein each production cycle involves:

removing liquid accumulated in the production chamber and lift chamber during the evacuation phase by executing the liquid reduction phase; and

removing liquid accumulated in the casing chamber during the

production cycle by executing the liquid removal phase.

17. (Original) A method as defined in claim 16 wherein the evacuation phase includes accumulating gas and liquid from the earth formation within the casing chamber, the production chamber and the lift chamber at the bottom of the well, the method further comprising:

flowing liquid from the production chamber to the lift chamber and from the lift chamber to the earth surface during the liquid reduction phase.

18. (Original) A method as defined in claim 17, further comprising:

preventing substantial liquid from flowing from the production chamber into the casing chamber during the liquid reduction phase.

19. (Original) A method is defined in claim 17, further comprising:

flowing at least some of the gas from the casing chamber directly out of the well during at least one of the liquid reduction phase or the liquid removal phase.

20. (Original) A method is defined in claim 17, further comprising:

establishing the relatively low pressure at a pressure which is less than atmospheric pressure at the earth surface.

21. (Previously Presented) A gas recovery apparatus for producing natural gas from a well and delivering the produced natural gas to a sales conduit, the well extending from the earth surface into a subterranean earth formation where the natural gas and liquid enter the well, the apparatus including tubing inserted into the well to create a casing chamber in fluid communication with the earth formation and a production chamber and a lift chamber which are separate from one another within the well, the apparatus also including a one-way valve separating the production chamber from the casing chamber, the gas recovery apparatus further comprising:

a compressor having a suction manifold and a discharge manifold, the compressor creating a flow of relatively low pressure gas in the suction manifold and a flow of relatively high-pressure gas in the discharge manifold;

control valves connecting each of the casing chamber, the production chamber and the lift chamber to the suction manifold and the discharge manifold to establish selective fluid communication between the suction manifold and each of the casing chamber, the production chamber and the lift chamber and to establish selective fluid communication between the discharge manifold and each of the casing chamber and the production chamber, the control valves also connecting the lift chamber and the discharge manifold to the sales conduit to establish selective fluid communication between the lift chamber and the discharge manifold and the sales conduit;

a controller programed to supply control signals to the control valves to establish an opened state of each valve to permit fluid communication therethrough and to establish a closed state of each valve to prevent fluid communication therethrough; the controller delivering a sequence of control signals to the control valves to establish the opened and closed states of the control valves which establish fluid communication conditions through the casing chamber, the production chamber, the lift chamber and into the sales conduit during a multi-phase gas recovery cycle; the gas recovery cycle including a liquid capture phase during which pressurized gas supplied by the compressor moves liquid from the casing chamber through the one-way valve into the production chamber, a liquid removal phase in which pressurized gas supplied by the compressor lifts liquid out of the well from the production chamber through the lift chamber, a three chamber evacuation phase executed by applying relatively low pressure within the casing chamber, production chamber and lift chamber to augment natural earth formation pressure in moving liquid and gas into the casing chamber, and a liquid reduction phase executed after completion of the evacuation phase and before executing the liquid capture phase, the liquid reduction phase executed by applying relatively low pressure within the casing chamber and relatively high pressure within the production chamber while the lift chamber is opened and connected to the sales conduit; and wherein:

the controller establishes the states of the control valves during the liquid capture phase to establish fluid communication between the discharge manifold and the casing chamber and to establish fluid communication between the suction manifold and the production chamber and the lift chamber;

the controller establishes the states of the control valves during the liquid removal phase to establish fluid communication between the discharge manifold and the production chamber and to establish fluid communication between the suction manifold and the casing chamber;

the controller establishes the states of the control valves during the evacuation phase to establish fluid communication between the suction manifold and the casing chamber, the production chamber and the lift chamber; and

the controller establishes the states of the control valves during the liquid reduction phase to establish fluid communication between the suction manifold and the casing chamber, to establish fluid communication between the discharge manifold and the production chamber, and to establish fluid communication between the lift chamber and the sales conduit.

22. (Original) A gas recovery apparatus as defined in claim 21, further comprising:

pressure sensors connected to sense pressure within the casing chamber, the production chamber and the lift chamber, the pressure sensors delivering pressure signals to the controller related to the sensed pressure within the casing chamber, the production chamber and the lift chamber;

flow sensors to sense the flow of natural gas from the lift chamber to the sales conduit and from the casing chamber to the sales conduit, the flow sensors delivering flow signals to the controller related to the sensed flow from the lift chamber to the sales conduit and from the casing chamber to the sales conduit, and wherein:

the controller selectively terminates each phase of the gas recovery cycle and establishes the next phase of the gas recovery cycle based on the

pressure signals and the flow signals, and wherein the apparatus further comprises:

an additional control valve connecting the casing chamber to the sales conduit to establish selective fluid communication between the casing chamber and the sales conduit, and wherein:

the controller establishes the state of the additional control valve to establish fluid communication between the casing chamber and the sales conduit during the liquid reduction phase.

23. (Not Entered) A method as defined in claim 15, further comprising:

flowing natural gas from the casing chamber out of the well during the liquid reduction phase.

24. (Not Entered) A method as defined in claim 15, further comprising:

beginning the liquid reduction phase after sensing a predetermined amount of natural gas flow from the casing chamber out of the well.

25. (Not Entered) A method as defined in claim 15, further comprising:

beginning the liquid reduction phase after sensing a predetermined pressure of natural gas in the casing chamber.

26. (Not Entered) A method as defined in claim 15, further comprising:

beginning the liquid reduction phase after sensing a predetermined reduction in natural gas flow from the casing chamber out of the well and after sensing a predetermined pressure of natural gas in the casing chamber.

27. (Not Entered) A method as defined in claim 15, further comprising:

reducing the amount of liquid to be lifted during the liquid removal phase by lifting liquid during the liquid reduction phase.

28. (Not Entered–Presently Amended) A method as defined in claim 36 ~~15~~ wherein the pressurized gas used during the gas recovery cycle to lift liquid through ~~from~~ the lift chamber is supplied by a compressor having a predetermined capacity, and the method further comprises:

establishing the quantity of liquid to be lifted during the liquid

reduction phase to not exceed the predetermined capacity of the compressor.

29. (Not Entered) A method as defined in claim 28, further comprising:

reducing the quantity of liquid to be lifted during the liquid removal phase by executing the liquid reduction phase; and

establishing the quantity of liquid to be lifted during the liquid removal phase to not exceed the predetermined capacity of the compressor.

30. (Not Entered) A method as defined in claim 29, further comprising:

beginning the liquid reduction phase after sensing a predetermined reduction in natural gas flow from the casing chamber out of the well and after sensing a predetermined pressure of natural gas in the casing chamber; and

selecting the predetermined reduction of natural gas flow from the casing chamber and the predetermined pressure of natural gas in the casing chamber at which to begin the liquid reduction phase to correlate to a column of accumulated liquid within the casing chamber at the well bottom.

31. (Not Entered) A method as defined in claim 30, further comprising:

selectively beginning the liquid reduction phase prior to the column of accumulated liquid presenting a hydrostatic head pressure greater than the natural earth formation pressure.

32. (Not Entered) A method as defined in claim 15, further comprising:

lifting quantities of liquid during the liquid reduction and liquid removal phases to maximize the duration of the evacuation phase.

33. (Not Entered–Presently Amended) A method as defined in claim 15, further comprising:

ending the liquid removal phase after sensing [[a]] predetermined pressures in the production and lift chambers.

34. (Not Entered) A method as defined in claim 15, further comprising:

preventing substantial liquid in the production chamber and the lift chamber from flowing into the casing chamber during the liquid reduction phase.

35. (Not Entered) A method as defined in claim 15, further comprising:

preventing substantial liquid in the casing chamber from flowing into the production chamber and the lift chamber during the liquid reduction phase.

36. (New) A method as defined in claim 15, further comprising:

applying relatively high pressure to lift the liquid accumulated within the production chamber during evacuation phase out of the well through the lift chamber.